

Ultra Long Duration Balloon Project

ULDB Project Plan (UPP) June 25, 1999

820-ULDB-UPP-002.0

Prepared By:		
		Date
Approved :	ULDB Systems Engineer	Date
Approved :		
прриочеш .	ULDB Project Manager	Date
Approved :		
11	Head, Balloon Projects Branch	Date

ULDB Project Plan

CHANGE CONTROL

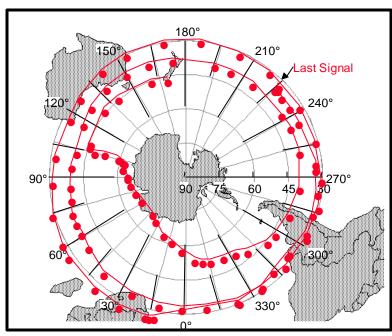
Revision	Modifications	Date Released	Modified by	
1.0	First Official Release	7-21-1997	Steve Smith	
2.0	Defined PDL roles/responsibilities, deleted old schedules	6-25-1999	Steve Smith	



Ultra Long Duration Ballooning



ULDB Project Plan Overview







NASA Balloon Program



WALLOPS FLIGHT FACILITY

Mission Statement

The Balloon Program Provides Support for Scientific Investigations Sponsored by the NASA Office of Space Science. Management of the Program is at Goddard Space Flight Center's Wallops Flight Facility.

Flight Operations Are Conducted Through an Extensive Mission Support Program Element Which Provides the Preparation, Launch, Tracking and Recovery of Each Flight.



ULDB Objective



WALLOPS FLIGHT FACILITY

Develop A Low Cost, Integrated, Advanced Long Duration Balloon System Capable of Supporting Global Scientific Observations Above 99 % of the Earth's Atmosphere for Durations Approaching 100 Days.



ULDB Project: Scope & Guidelines



WALLOPS FLIGHT FACILITY

Scope

To Build Upon the Balloon Philosophy and Legacy in the Identification, Adaptation and Implementation of Relevant Technologies Found in the Aeronautical, Spacecraft and Military Environments in Order to Develop a New Science Support Capability.

Guidelines

- Demonstrate Viability of New Platform for Accomplishing Meaningful Science
- Demonstrate Necessary Technologies Associated with 100 Day Missions
- No New Program Money Identified
- Use Civil Service Personnel to Largest Extent Possible



ULDB Project Approach



WALLOPS FLIGHT FACILITY

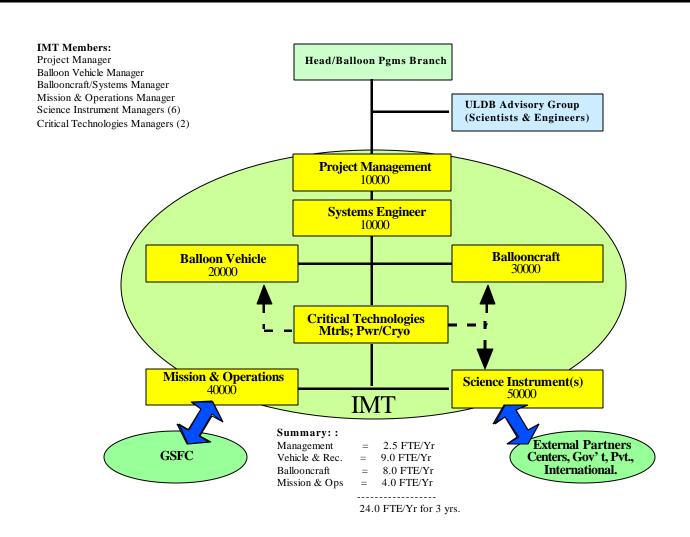
- Primary Funding From Within Balloon Program -- No New Funds Identified
- ULDB Does Not Replace Existing Conventional Balloon Program
- Balloon Technology Development On-going in Parallel w/ ALDB Development Effort
- ULDB Integrated Management Team: 8-10 People Responsible for Development Comprised of WFF, GSFC, PSL & Science Community.
- Technical Areas :Balloon Vehicle & Recovery, Science, Ballooncraft, Mission & Operations
- ULDB Advisory Group: Composed of Science & Technical Personnel Appointed to Review Development Progress
- Controls:
 - IMT: Bi-weekly Telecons & Monthly Status Meetings
 - ULDB Advisory Group : Semiannual Reviews
 - Design Reviews
 - Reporting to Head, Balloon Program Office



ULDB Organizational Structure



WALLOPS FLIGHT FACILITY





ULDB Requirements (GSFC/Polidan Study)



WALLOPS FLIGHT FACILITY

Purpose

- Document Requirements for Beyond Demo Flt.
- Identify Applicable Technologies
- Identify Technical Challenges of the ULDB Program
- Provide Input to WFF ULDB Development/Demo
- Provide Info to Possible Non-Balloon Users

Status

- Chartered Oct. '96
- User Requirements Workshop Nov. '96
- Interim Report April '97

1.0 ULDB System Definition Phase Roles and Responsibilities

During the System Definition phase, Code 820 requested Code 500 support in the following discipline areas:

- 3.1 Power
- 3.2 Electrical
- 3.3 Telemetry
- 3.4 Command & Data Handling
- 3.5 Sensors
- 3.6 Attitude Control
- 3.7 Cryogenics
- 3.8 Thermal
- 3.9 Mechanical
- 4.2 Ground Telemetry
- 4.4 Control Center

The primary responsibility of the Code 500 support personnel during this phase was to perform trade studies and identify the optimum "end items" or "configuration items (CIs)" that should be developed.

2.0 ULDB Design Phase Roles and Responsibilities

During the Design Phase, all configuration items (CIs) needed to be allocated to PDLs. We currently have 11 Code 500 PDLs, most with responsibility for multiple CIs (see Tables One and Two). The responsibilities of the PDLs during the Design Phase include the following:

- 2.1 Each PDL shall develop an Implementation Plan/Product Plan that includes the following (at a minimum). This Plan shall be reviewed and approved by Code 820. This plan shall be a quality record maintained by the PDL until Project completion. Guidance for the content of this plan can be found in GPG 8700.1B and in 500-PG-8700.2.2 Section 6.2.1
 - A. Establish Goals and Objectives. The PDL shall establish the goals and objectives for the design process as a baseline for all subsequent planning activity. Where appropriate, this includes the development of requirements and/or specifications for the product or service being designed. The design requirements shall be traceable to the customer requirements (see GPG 1310.1).
 - B. Description of the approach to be taken during design and verification and a high level description of the CI(s) to be developed. Identification of CIs and the Product Breakdown Structure (PBS) numerical designation of the CIs shall be included.
 - C. Product Design Team (PDT) identification. The PDL shall identify civil service and contractor support areas needed for design, development and testing of their CI(s). Level of effort (percentage of FTE) estimates shall be included.
 - D. Budget

- Each PDL shall submit a budget which includes CI development cost plus verification and validation costs (contractor test support, test equipment, etc.). The budget shall be phased to show when expenditures are planned.
- E. Schedule including design, development, testing and Peer Review Plan.
- 2.2 Each PDL shall develop and generate a Detailed Requirements Document for their Product(s). This document shall include derived (lower level design) requirements. Per 500-PG-8700.2.2 Section 6.3, the PDL and PDT are responsible for definition of the lower level design requirements.
- 2.3 Each PDL shall submit a Monthly Status Report to Code 820 by the first day of each month. The Status Report shall be in the form of email attachments. The Status Report shall address progress, issues and include schedule and budget updates. The PDL shall clearly identify if they are ahead of or behind schedule, shall submit a revised schedule if necessary, and shall document cumulative funds expended versus funds budgeted.
 - The ULDB Project shall make the PDL status reports available to other PDLs by posting them on the WFF LAN. The ULDB Project shall also make the monthly ULDB Balloon Vehicle, Operations and Instrument status reports available by posting them on the WFF LAN.
- 2.4 Each PDL shall schedule and present their design at a Subsystem Critical Design Review (CDR) Peer Review. These review shall be scheduled prior to the end of September 1999. Guidelines are found in 500-PG-8700.2.2 Section 6.6.2. At the subsystem CDR the PDL shall provide the design output in accordance with 500-PG-8700.2.2 Section 6.9 (including drawings, specifications, interfaces, and procedures for integrated system verification, operation, maintenance, checkout and validation). The design output will be given a Configuration Control Document (CCD) designation and will be placed under project configuration control. The CCD, Peer Review package, action items, and responses are quality records and will be maintained by the PDL until Project completion.
- 2.5 Each PDL shall perform design verification on their CI(s) to ensure that the design meets the requirements. This verification will result in the PDL certifying that their CI(s) are flight qualified and will therefore include environmental testing. Per 500-PG-8700.2.2 Section 6.7.4, the results of design verification shall be maintained as quality records by the PDL until Project completion.
- 2.6 Each PDL shall be responsible for Work Order Authorizations (WOAs) as required by GPGs (GPG-5330 and related). WOAs will be used, at a minimum, to specifically address in-process inspection and test events including all functional and environmental tests required for design verification and validation (see GPG 8700.2 and GPG 8700.3) and product handling with handling devices (see GPG 6400.1). WOAs shall be maintained as quality records by the PDL until Project completion.

- 2.7 The Project (Code 820) will generate and maintain the quality records list. The PDLs will generate and maintain the quality records.
- 2.8 Each PDL shall participate in periodic Ballooncraft Team Meetings. The Ballooncraft Manager shall schedule the meetings. The meetings shall emphasize team members' issues and concerns, and action items shall be established as necessary.

3.0 ULDB Integration & Test Phases Roles and Responsibilities

This activity is split into two phases, the Assembly/Integration phase and the Integrated Test Phase.

3.1 Assembly/Integration Phase

Code 500 shall provide an Integration Team of engineering support personnel in addition to the CI PDLs. The core team shall consist of the following engineering disciplines with the expectation that existing PDLs will be able to perform these functions:

(These assignments are pending)

Power	Mike Smolinski or Jim Lagarde/565
Command & Data Handling	Linda Thompson/565 or Henry Hart/565

Telemetry Brian Corbin/567

GNC Kenny Hall or Barton Bull/571
Mechanical Bob Ray or Chris Shreves/546
Flight Software Roger Mason or Rodney Davis/584
Ground Software Pam Pittman/588 or Debbie Parks/584

The electronic subsystems related team members shall be responsible for generating a Wiring Book similar to what is used in the Sounding Rocket Program, which will be used by the Electrical Technicians to wire the Ballooncraft. The Mechanical team member shall be responsible for all mechanical assembly and for generating a Mechanical Systems Manual. Flight and Ground Software responsibilities will continue as before and shall be responsible for generating Flight and Ground Software Manuals.

The Integration Team shall also be responsible for preparing and making presentations at the System level reviews, Mission Readiness Reviews, and Flight Readiness Reviews.

The CI PDLs will continue to be responsible for their CI(s), and will also support the Integration Team as required.

This Phase ends when the Ballooncraft is fully assembled, wired and tested.

3.2 Integrated Test Phase

During this phase, the Integration Team and the Ballooncraft/Integration Manager shall schedule all integrated test activities (System Verification). The Integration Manager shall be provided by Code 820. The CI PDLs shall support these activities as required by the Ballooncraft/Integration Manager. The first Engineering Test Flight (spring 2000) shall be considered part of the Ballooncraft System Verification. The second Engineering Test Flight (December 2000) shall be considered part of the Ballooncraft Systems Acceptance Tests (Validation). After the second Engineering Test Flight, a Support Systems Acceptance Review (SSAR) will be conducted. Then, integration & test with the Instrument shall occur. This activity shall also be considered part of the Ballooncraft System Acceptance Tests (Validation). The successful conclusion of the Instrument integration and test into the Ballooncraft shall result in System Acceptance, and a Demo/TIGER Mission Readiness Review shall be conducted.

The System CDR will occur after the 1st Engineering Test Flight. The Support Systems Acceptance Review will occur after the 2nd Engineering Test Flight.

3.3 Deployment and Launch Phase

This Phase consists of the deployment preparation activities, the movement of equipment and personnel to the launch site, the pre-launch checkout activities and the actual launch of the ULDB Demonstration Flight. The Integration Team identified above shall travel to the launch site and shall be responsible for configuration and prelaunch activities (with technician support).

4.0 Configuration Management

For the ULDB Project, configuration management procedures shall be applied at the Project level. The Configuration Control Board (CCB) shall consist of the ULDB Integrated Management Team (IMT). The documents under configuration control shall be the PDL Implementation Plans and the PDL Design Outputs (CCDs). The identification procedure for these two documents shall be as follows:

- 4.1 Implementation Plans (IMP)
 820-ULDB/TIGER-XXX IMP-YYY.Y where XXX is the PDL Title (i.e. Flight
 Processing Hardware) and YYY.Y is the revision number (i.e. 001.0 for the initial
 release). If the PDL chooses to have multiple IMPs for their area (i.e. one for each
 Configuration Item), XXX shall be descriptive of the Configuration Item(s) covered.
- 4.2 Configuration Control Document (CCD)
 820-ULDB/TIGER-XXX CCD-YYY.Y where XXX is the PDL Title (i.e. Flight
 Processing Hardware) and YYY.Y is the revision number (i.e. 001.0 for the initial
 release). If the PDL chooses to have multiple CCDs for their area (i.e. one for each
 Configuration Item), XXX shall be descriptive of the Configuration Item(s) covered.

The IMP documents shall be baselined and placed under configuration control prior to the subsystem Critical Design Reviews. The CCD documents shall be baselined and placed under configuration control at the time of the subsystem Critical Design Reviews.

The identification and documentation of change requests shall be via email change requests from the PDL to the ULDB Project Systems Engineer. The email shall include the requested change(s) as attachments. The ULDB Project Systems Engineer shall evaluate the change request, and shall convene the IMT as necessary for evaluation. Approval of change requests shall be via email from the ULDB Project Systems Engineer to the PDL. Documentation of change approval shall be via a revision sheet placed in the document that includes the revision release date and revision number.

Table One

Product Design Leads for ULDB Development

1. Mike Smolinski/565

PDL Title: Power and Electrical PDL

2. Brian Corbin/567

PDL Title: Telemetry PDL

3. Henry Hart/565

PDL Title: Flight Processing Hardware PDL

4. Linda Thompson/565

PDL Title: Data Acquisition and Storage PDL

5. Dwayne Morgan/584

PDL Title: TDRSS Data Interface PDL

6. Roger Mason/584

PDL Title: Flight Software PDL

7. Barton Bull/571

PDL Title: GPS and Sensors PDL

8. Kenny Hall/571

PDL Title: Attitude Control PDL

9. Bob Ray/546

PDL Title: Cryogenics and Mechanical Enclosures PDL

10. Chris Shreves/546

PDL Title: Mechanical Structures, Deployment and Flight Train PDL

11. Pam Pittman/588

PDL Title: Control Center PDL

Table Two

Product Design Leads and Configuration Items (Products) for ULDB Development

1.	Mike Smolinski/565		Power and Electrical PDL	
	Products:	3.1	Power Subsystem	
		3.2	Electrical Subsystem	
2.	Brian Corbin/567		Telemetry PDL	
	Products:	3.3.1	TDRSS	
		3.3.2	INMARSAT	
		3.3.3	ARGOS	
		3.3.4	Line of Sight transmitters	
		3.3.5	Line of Sight receivers	
		3.3.6	Iridium	
		4.2	Ground Telemetry Systems	
3.	Henry Har	t/565	Flight Processing Hardware PDL	
	Products:	3.4.3	Flight Processor	
4.	Linda Thompson/565		Data Acquisition and Storage PDL	
	Products:	3.4.1.1	Wiring and Connectors	
		3.4.1.2	Data & Command Decks & Stacks	
		3.4.1.3	Data & Command Switching & Distribution Units	
		3.4.2	Data Storage	
5.	Dwayne Morgan/584		TDRSS Data Interface PDL	
	Products:	3.3.1.6	TDRSS Data Interface	
6.	Roger Mason/584		Flight Software PDL	
	Products:	3.4.4.	Flight Software	
7.	Barton Bull/571		GPS and Sensors PDL	
	Products:	3.5.1	GPS	
		3.5.2	Sensors	
8.	Kenny Hall/571		Attitude Control PDL	
	Products:	3.6	Azimuth Positioner	
9.	Bob Ray/546		Cryogenics and Mechanical Enclosures PDL	
	Products:	3.7	Stirling Cycle Cryogenic Cooler	
		3.9.2	Enclosures	
		3.9.3	Gas Makeup System	
10.	Chris Shreves/546		Mechanical Structures, Recovery subsystem and	
			Flight Train PDL	
	Products:	2.2.2	Ballast Subsystem	
		2.3	Recovery Subsystem	
		2.4	Flight Train Subsystem	
		3.9.1	Ballooncraft Structure	
11.	Pam Pittman/588		Control Center PDL	
	Products:	4.4.1	Operations Control Center	
		4.4.2	Remote Operations Control Center	